

A STUDY ON THE ANALYSIS OF SPACE AND STRUCTURAL INTERFACE FOR IMPROVEMENT OF THE TRANSFER PATH IN A METRO STATION

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ABSTRACT

As the number of metro user increases recently, the severe congestion is repeated and the inconvenience of passengers increases. Due to the structural limit of stations, most of the metro stations are required to reduce transfer distance and time and make flow for the disabled better. In this study was investigated the present conditions of space and structural interface in a metro station through a field survey. Based on the results, the improvement in the transfer path for the general passengers and the disabled are suggested.

KEYWORDS: *Transfer Path, Space Interface, Structural Interface, the Disabled, Level of Service*

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INTRODUCTION

As the number of metro users increased recently, the severe congestion is repeated and the inconvenience of passengers increases. Especially the transfer during rush hour is increasing, the transfer time is increased and passenger collision is occurred because of long distance and congestion in transfer passage. The threat for safety and the inconvenience of passengers is increasing. Therefore most of the metro stations are required to reduce transfer distance and time and make flow for the disabled better. In this study was investigated the present conditions of transfer passage width, density, speed, space and structural interface in the metro station of Daegok through a field survey. Based on the results, the improvement in the transfer path for the general passengers and the disabled are suggested.

REVIEW OF TRANSFER PATH

Passengers Satisfaction of Transfer Passage

Domestic metro transfer passage design follows the metro station and transfer facilities complementary design guidelines. LOS (Level of Service) standard is based on the theory by John J. Fruin. It is a summary of LOS in waiting rooms, pedestrian passages and stairs in the stations and it is listed in the following Tables 1. LOS can be divided into six steps from A to F and it refers that LOS A is the best condition and LOS F is the worst condition. It specifies occupied area, the flow coefficient, and density for each service level. In view of efficiency of investment funding in the social and economic aspects, LOS of platform and stairs is on the grade D and LOS of transfer passage is on the grade E during rush hours with the highest number of passengers.

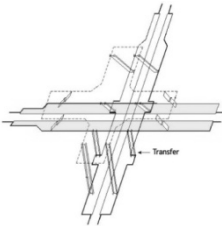
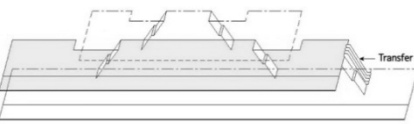
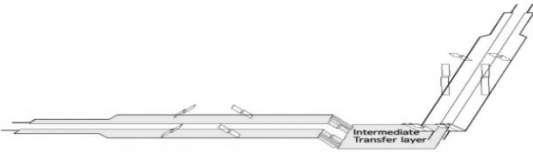
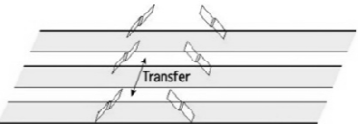
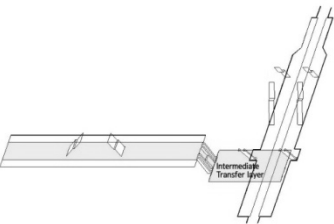
Table 1: Fruin's LOS in the Width of Passage Way

LOS	Space Module (m ² /Person)	Flow Coefficient (Person/m·min)	Density (Person/m ²)	Ambulatory Status
A	Over 3.5	Below 20	Below 0.3	Free choice of walking speed
B	2.5-3.5	20-30	0.4-0.3	Overtaking in same direction as the normal speed
C	1.5-2.5	30-45	0.7-0.4	Restriction of freedom of walking speed overtaking
D	1.0-1.5	45-60	1.0-0.7	Restriction of walking speed
E	0.5-1.0	60-80	2.0-1.0	Disable normal walking speed
F	Below 0.5	Over 80	Over 2.0	Pushed steps, Stopped

Transfer Type and Characteristics

The transfer types of metro station are divided into cross type (+-type), angle type (L-type), T-type, parallel type, duplex type and their features are shown in the Table 2.

Table 2: Transfer Types

Transfer Type	Characteristics	Reference
+ - Type	<ul style="list-style-type: none"> -The most general form -Structure intersected in the cross-shape for approximately 90 degrees -Relatively easy to transfer 	
DuplexType	<ul style="list-style-type: none"> -Short transfer circulation and simple transfer moving flow -No need to install a separate intermediate transfer layer 	
L-Type	<ul style="list-style-type: none"> - Transfer moving flow is long but simple. 	
Parallel type	<ul style="list-style-type: none"> -Form to transfer side by side -Transfer is the simplest but if landing floor is different, transfer path becomes long. - Floor is the same and it is possible to transfer immediately from the landing without vertical movement. 	
T-Type	<ul style="list-style-type: none"> - Transfer moving flow is slightly short and simple 	

DAEGOK STATION TRANSFER PATH STATUS AND IMPROVEMENTS

Daegok Station Transfer Path Field Survey and Results

Daegok Station is a T-Type transfer station of line 3 (3 floors above the ground) and Gyeongui-center line (ground floor). The transfer distance is about 232m owing to the transfer passage length. The transfer time of general passengers takes about 3.87 minutes. The transfer time of the disabled takes about 7.98 minutes because transfer distance is about 479m. Elevator is installed in both the moving and transfer path, but it takes a lot of transfer time because of the long passage and biased exit. The passengers are 1,356 people per 1 day, whereas the transfer passengers are 42,285 people per 1 day in 2014. The transfer percentage is trend to increase greatly due to the increased Gyeongui-center line train service.

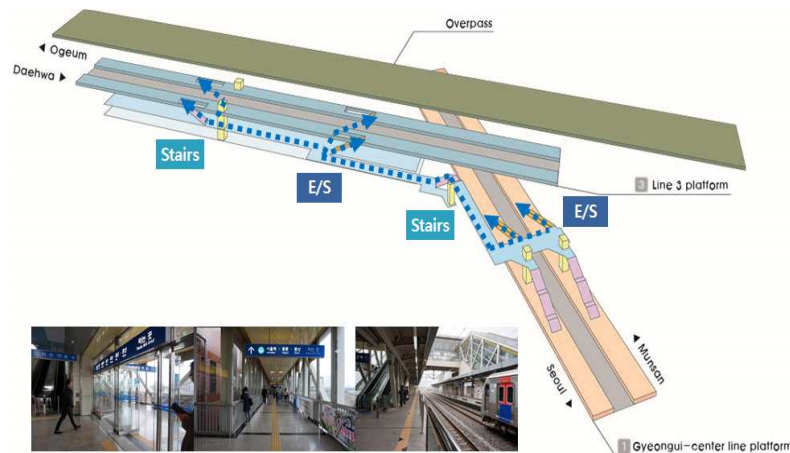


Figure 1: Transfer Path of General Passengers

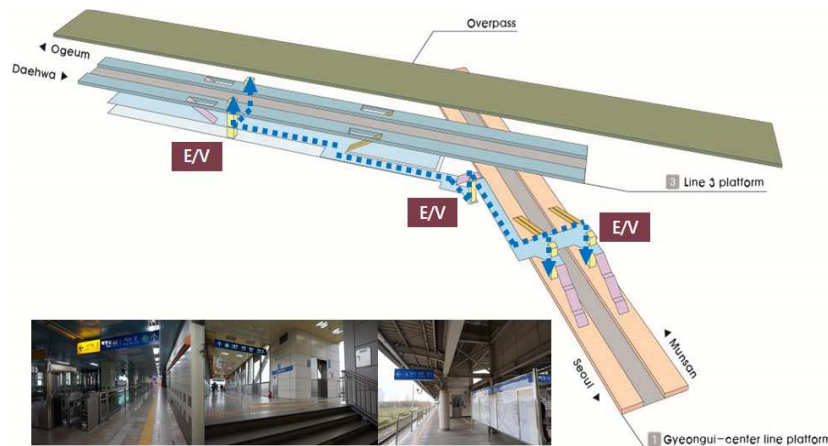


Figure 2: Transfer Path of the Disabled

Table 3: Daegok Station Moving and Transfer System Status

Division	Evaluation Items	1	2	3	4	5	6	7	8	9
Passage	Height(m)	3.4	3.4							
	Width(m)	4	3.8							
External stairs	Numbers(ea)	34	34	34	34	28				
	Size (Length/Width) (mm)	350/140	350/140	350/140	350/140	340/150				
	Width(m)	3.9	3.9	3.9	3.9	5.3				
	Landing(m)	1.5	1.5	1.5	1.5	1.8				

Table 3: Contd.,										
Internal stairs	Numbers(ea)	47			47	29	46	46		
	Size (Length/Width) (mm)	350/140			350/140	300/140	310/150	310/150		
	Width(m)	3.4			3.4	4.1	3.2	3.2		
	Landing(m)	1.5			1.5	1.9~5.3	1.5X2ea	1.5X2ea		
E/S and M/W	Numbers(ea)		2	2					2	2
	Width(m)		0.9	0.9					0.9	0.9
	Height(m)		6.58	6.58					7.05	7.05
E/V	Installed or not	1	2	3						
W/L	Installed or not	X								

Space and Structural Interface Analysis

As a result of the trolley wire interface analysis, structure should be installed at least 7.24m in height from the platform for metro station structure limit and safety conditions. The minimum space of 6m from the existing E/S and 1.5m from the platform is required according to the metro station and transfer facilities complementary design guidelines. Overpass is parallel installed with line 3 and the width of line 3 platform up to overpass is 5.6m. As a result of overpass structure interface analysis, it is difficult that structures installed near the overpass. The structures installation at platform was analyzed as possible after reinforced base structure.

Transfer Path Improvement

The long passages and many stairs are very inconvenient for the disabled to use. When the vertical and horizontal trip system is applied to connect Gyeongui-center line and line 3 directly, transfer distance is reduced to 38.4m. The general passenger is about 83.4% and the disabled is about 92.0% reduction. The vertical and horizontal trip system moves to the vertical as well as horizontal similar to the elevator. The system can effectively improve the transfer path. The height of structure is 15.06m and the width is 8.11m for Daegok Station.

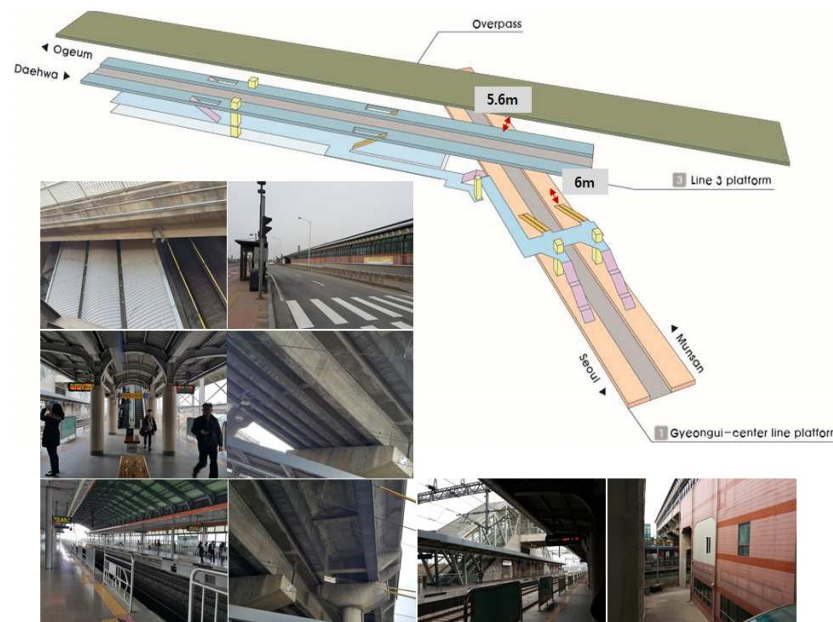


Figure 3: Space and Structural Interface

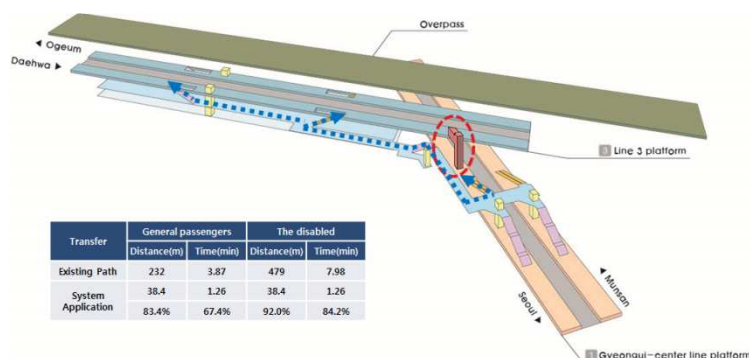


Figure 4: Transfer Path Improvement

CONCLUSIONS

As the number of metro users increased recently, most of the metro stations are required to reduce transfer distance and time. Therefore the improvement in the transfer path for the general passengers and the disabled are suggested. In this study was investigated the present conditions of space and structural interface on Daegok station through a field survey. The following conclusions were derived.

- Daegok Station is a T-Type transfer station of line 3 (3 floors above the ground) and Gyeongui-center line (ground floor). The transfer percentage is trend to increase greatly due to the increased Gyeongui-center line train service. The transfer distance is about 232m owing to the transfer passage length. The transfer time of general passengers takes about 3.87 minutes. The transfer time of the disabled takes about 7.98 minutes because transfer distance is about 479m.
- The minimum space of 6m from the existing E/S and 1.5m from the platform is required according to the metro station and transfer facilities complementary design guidelines. As a result of the trolley wire interface analysis, structure should be installed at least 7.24m in height from the platform. The structures installation at platform was analyzed as possible after reinforced base structure.
- When the vertical and horizontal trip system is applied to connect Gyeongui-center line and line 3 directly for improvement of long passages, transfer distance is reduced to 38.4m. The general passenger is about 83.4% and the disabled is about 92.0% reduction. The system can effectively improve the transfer path.

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